Augustana University SiPM Test Stand Update

Trevor Tecklenburg[2], Vivian Zhou[1], Drew Alton[1], Nathan Grau[1]

[1]Augustana University
[2]South Dakota School of Mines and Technology

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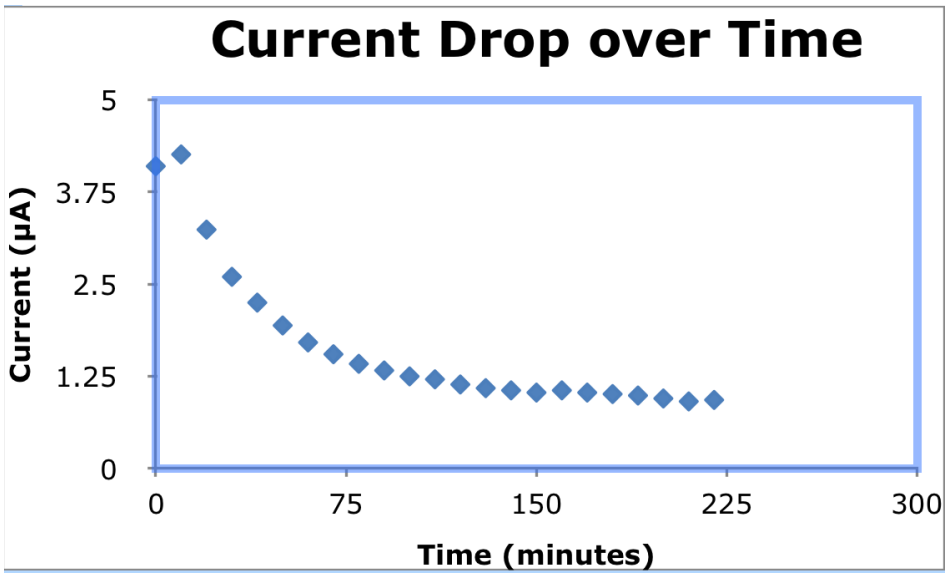
The Test Stand

- Old Image of our setup
  - Dark box with SiPM, Rev C board, LED
  - Keithley PS and dual-channel PS for preamp.
  - Consolidated connections inside the dark box.
  - Output to DRS4 digitizer and into desktop with RCDAQ

Current Draw without LED



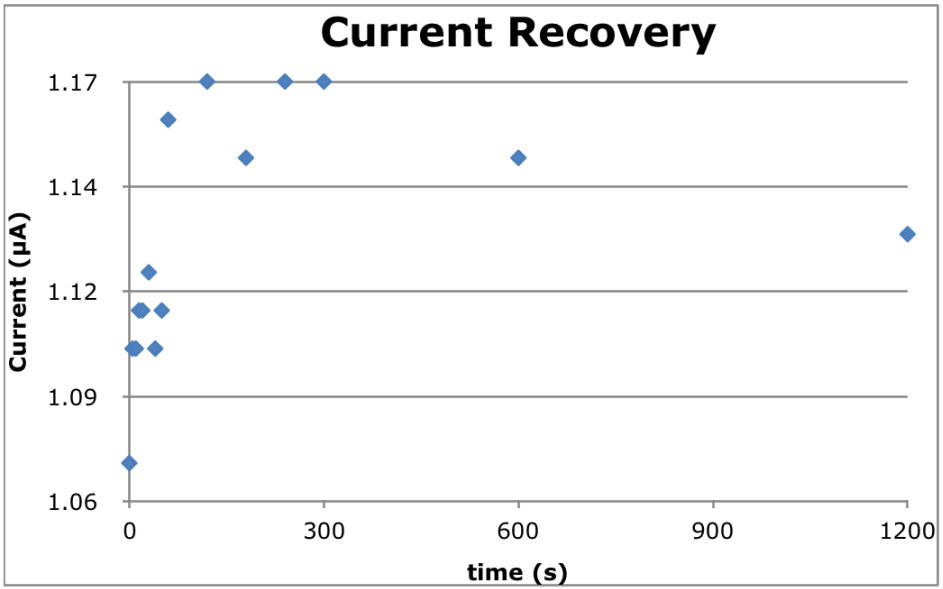
- Measure current draw on SiPM with power to preamp and bias voltage and NO LED.
- Current drops over several hours.
- Clearly some extra capacitance around but we've been unable to identify it.

Current Draw without LED

- Decrease continues to drop 50% over three days.

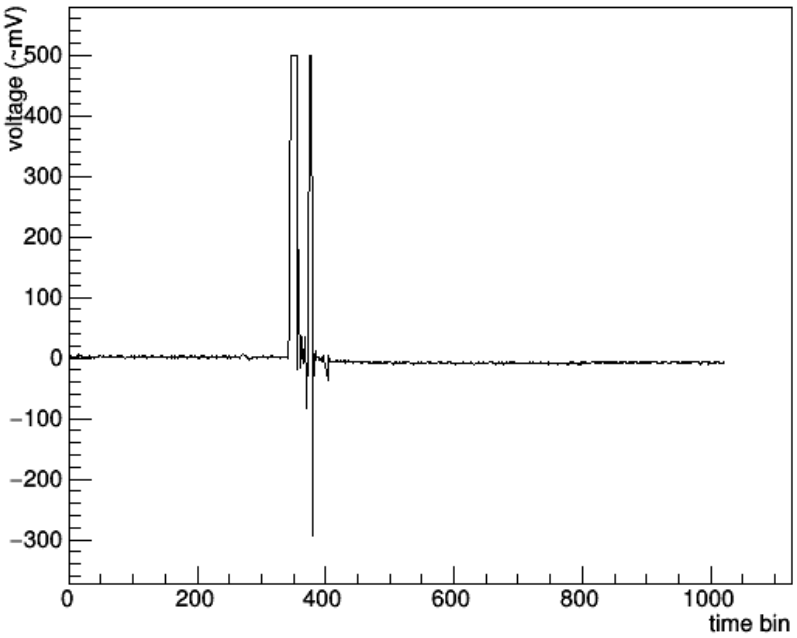
time	current μA
4:35 PM	0.86
10:23 AM	0.51
5:31 PM	0.53
1:36 PM	0.46
1:00 PM	0.49

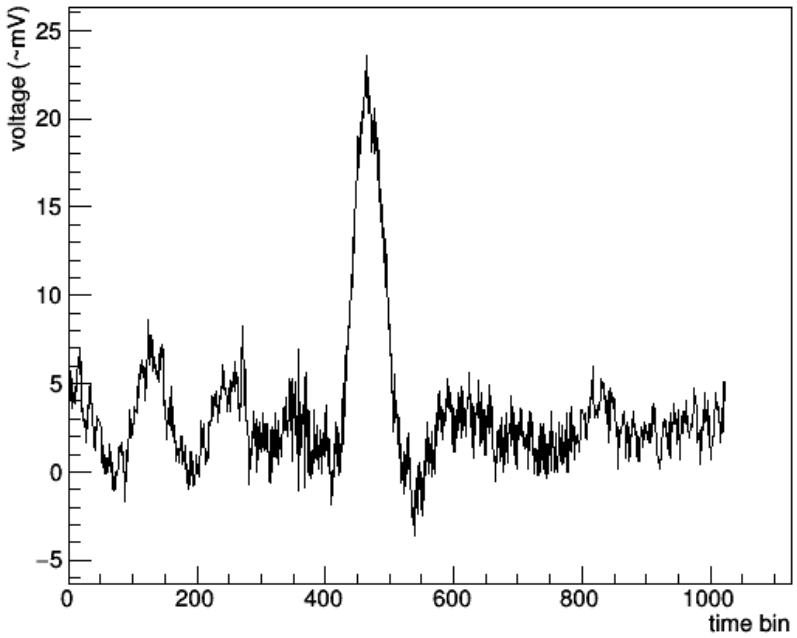
Current Draw without LED



- Measure the current after bias being off for a given amount of time.
- Recovery looks different than drop.
- Poor scientist's solution: just leave it on continually.

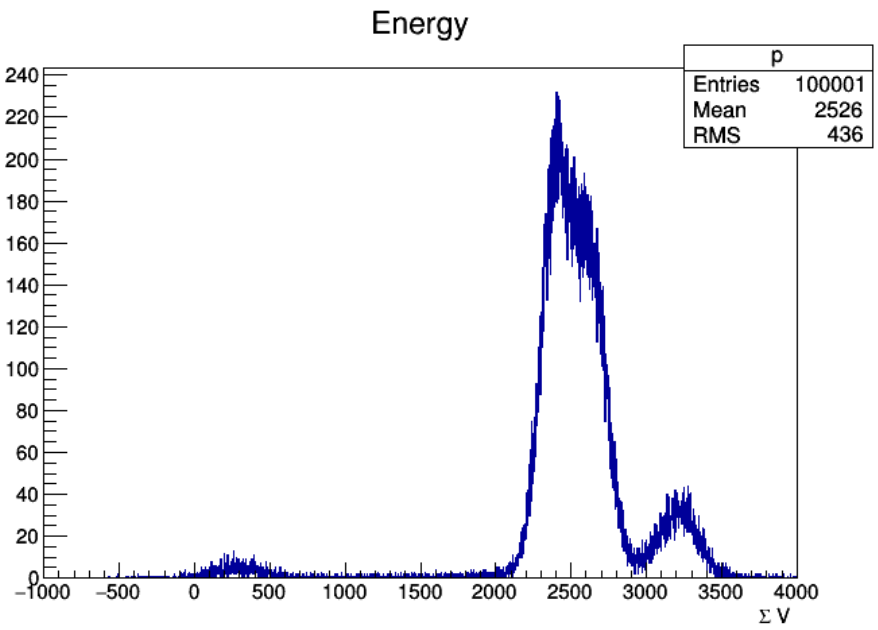
Digitizing the Signal





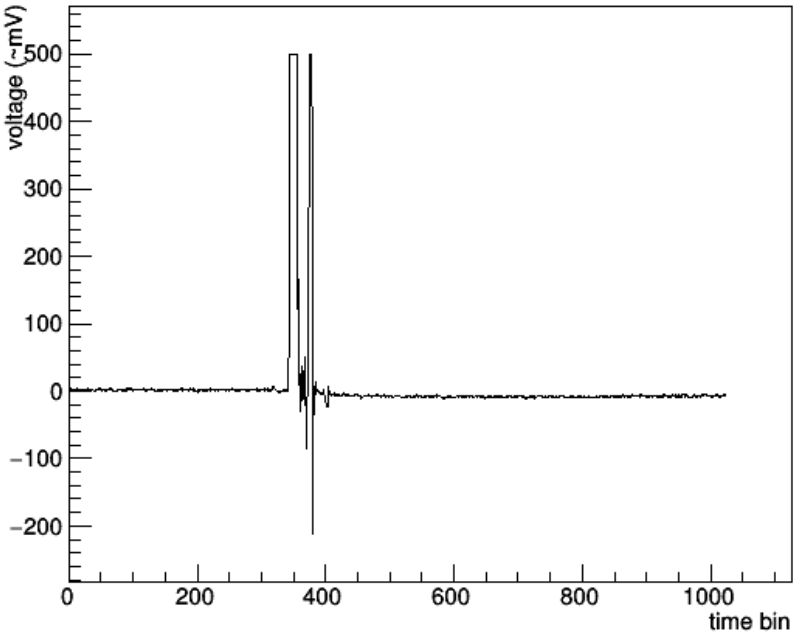
- Put LED pulser (left) and SiPM output (right) into DSR4 board. Trigger on LED pulser.
- Turned down LED voltage to as low as possible to separate the LED signals from "background".

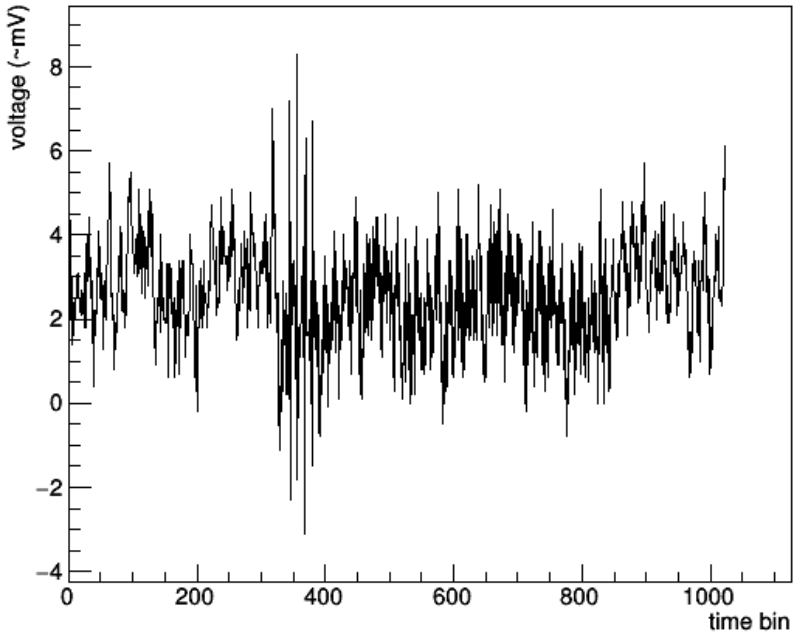
Looking for Photoelectron Peaks



- Integrated SiPM signals.
  - Large peak from "background" and peak on right from SiPM.
  - "Background" from pedestal and noise.

Digitizing the Signal





- Event with no obvious LED signal
- $\sim$3 mV offest and $\sim$ 2 mV fluctuations.

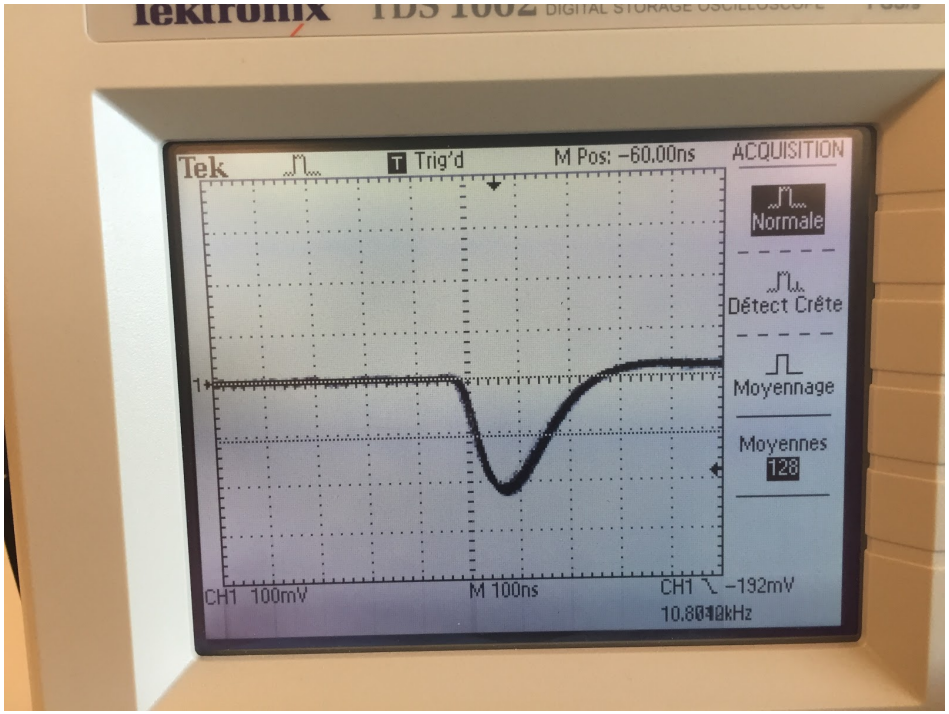
Back-Ups

Introduction

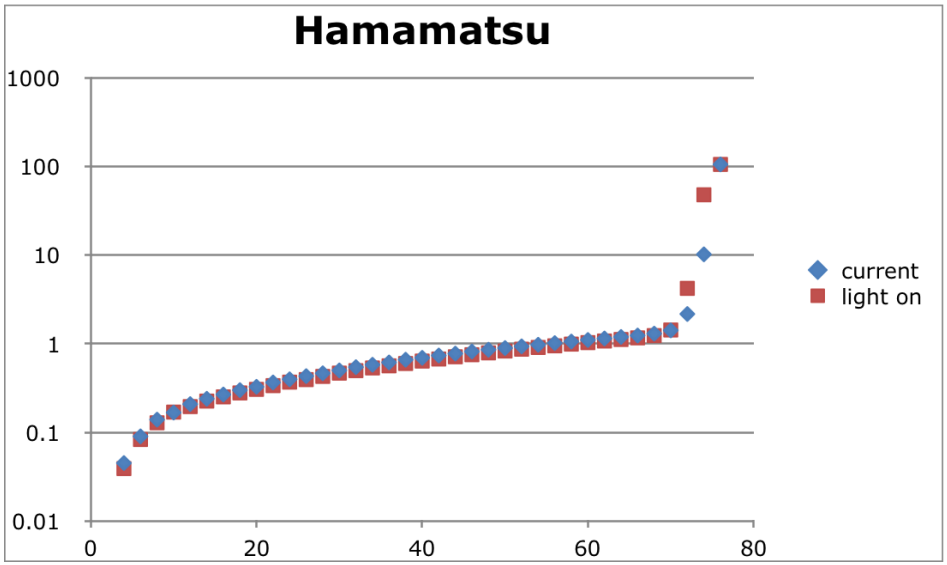
- Augie's contribution to sPHENIX.
  - Collaboration has 100k+ SiPMs to test, categorize, etc.
  - Augie has several resourceful undergraduates.
  - We can't test them all. But we can certainly help.
- Augie's good fortune: 2/3 of faculty (DA and NG) working with SiPMs
  - DarkSide, 3rd generation dark matter search detector also using SiPMs.
  - Can share costs, equipment, students, etc.
- Vivian spent over 1 month at UIUC making 2-d projective modules and learning their SiPM test stand setup. Also visited with UMich briefly to coordinate activities.
- Vivian and Trevor have spent the last several weeks putting together the test stand.

Low Gain LED Signal

- With LED, signal doesn't look unreasonable.
- Right now noise is worse – from a 7 μs RF signal.



I-V of Hamamatsu 15 μm SiPM



- After being on for a while so current settles, measure I-V curve without LED.
- Doesn't look unreasonable. But didn't double check the suggested operating voltage.